

Mandibular Implant-Supported Overdentures: A Narrative Review for Optimum Selection of Attachment Systems

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[Cite this paper as:](#) Dr. Ashwini Vilas Bharsakle, Dr. Saleha Ilyas Shaikh, Dr. Tanvi Dnyaneshwar Padvi, Dr. Pankaj Samadhan Murkut, Dr. Harikumar Memapally, Dr. Himanshu Srivastava, Dr. Aditi Subhashchandra Sarda (2024) Mandibular Implant-Supported Overdentures: A Narrative Review for Optimum Selection of Attachment Systems..Journal of Neonatal Surgery, 13, 2326-2329

ABSTRACT

Mandibular edentulism significantly affects mastication, speech, and quality of life, particularly among elderly individuals. Implant-supported overdentures have emerged as a predictable and effective treatment modality to overcome the limitations of conventional complete dentures. While the placement of two implants in the interforaminal region is widely accepted as the standard of care, the selection of an appropriate attachment system remains a subject of ongoing debate. This narrative review aims to synthesize current evidence from PubMed-indexed systematic reviews and meta-analyses to evaluate various attachment systems, including stud, bar, magnetic, and telescopic attachments, in terms of implant survival, prosthodontic maintenance, retention, peri-implant tissue response, and patient satisfaction. The evidence suggests that although implant survival rates are comparable across attachment systems, significant differences exist in maintenance requirements and patient-centered outcomes. Locator attachments appear to offer an optimal balance between retention, resilience, and maintenance, making them a preferred choice in many clinical situations. However, the selection of attachment systems should be individualized based on anatomical, functional, and patient-related factors...

INTRODUCTION

Edentulism of the mandible remains a prevalent clinical condition that adversely affects oral function, esthetics, and psychosocial well-being. Conventional complete dentures often fail to provide adequate retention and stability due to continuous alveolar ridge resorption, particularly in the mandibular arch. Implant-supported overdentures (ISODs) have revolutionized the management of edentulous patients by significantly improving retention, stability, and patient satisfaction. The McGill Consensus Statement established that a two-implant overdenture should be considered the minimum standard of care for edentulous mandibles¹. Numerous longitudinal and systematic studies have demonstrated high implant survival rates exceeding 95%, along with improved oral health-related quality of life in patients treated with mandibular overdentures^{2, 3}. Despite consensus regarding implant number and placement, the choice of attachment system remains controversial. Various attachment systems, including stud attachments (ball and locator), bar attachments, magnetic systems, and telescopic crowns, exhibit different biomechanical behaviors and clinical outcomes. These differences influence stress distribution, prosthetic maintenance, and patient satisfaction. Therefore, an evidence-based approach is essential for optimal selection of attachment systems. This narrative review aims to critically analyze available systematic reviews and meta-analyses to provide comprehensive clinical guidance for selecting appropriate attachment systems in mandibular implant-supported overdentures.

Classification of Attachment Systems

Table 1: Classification of Mandibular Overdenture Attachment Systems

Category	Examples	Mechanism	Key Features
Stud attachments	Ball, Locator, ERA	Individual resilient	Simple, cost-effective
Bar attachments	Hader bar, Dolder bar	Splinted rigid/semi-rigid	High retention, splinting
Magnetic attachments	Magnet systems	Attractive force	Low retention, easy insertion
Telescopic attachments	Conus crowns	Frictional fit	Excellent stability, costly

2. Biomechanics and Stress Distribution

The biomechanical performance of implant-supported overdentures is significantly influenced by the type of attachment system used, as it governs load transmission to the implants and surrounding bone. Resilient attachment systems, such as locator and ball attachments, allow controlled rotational and vertical movement of the prosthesis, thereby reducing stress concentration at the bone-implant interface and promoting favorable load distribution. This resilience is particularly beneficial in minimizing marginal bone loss and enhancing implant longevity. In contrast, bar attachment systems splint the implants together, increasing prosthesis stability but also resulting in higher stress concentration due to restricted movement. Magnetic attachments, although advantageous in terms of ease of insertion and reduced lateral forces, have been associated with less favorable stress distribution patterns and reduced retentive capacity. Finite element analyses consistently demonstrate that attachment systems permitting rotational freedom result in improved biomechanical outcomes and reduced peri-implant stress^{4,5}.

3. Comparative Evaluation of Attachment Systems

Implant survival rates across different attachment systems are consistently high, typically ranging from 93% to 100%, indicating that attachment type does not significantly influence implant survival when proper protocols are followed. Studies have shown comparable survival rates between bar and ball attachments, whereas magnetic attachments tend to demonstrate slightly lower survival outcomes. Kim et al. reported survival rates of 95.8–97.5% for bar attachments and 96.2–100% for ball attachments, with magnetic systems showing relatively lower performance⁶.

Prosthetic maintenance represents a critical determinant of long-term success. Bar attachments, although providing superior retention and stability, often require complex maintenance, including clip replacement and adjustments. In contrast, stud attachments such as locator and ball systems are simpler and more cost-effective but require periodic replacement of retentive components due to wear. These differences influence long-term cost-effectiveness and patient compliance^{7,8}.

Retention and stability are key factors influencing functional performance and patient satisfaction. Bar attachments provide the highest retention due to splinting of implants, while locator attachments offer an optimal balance between retention and resilience. Ball attachments provide moderate retention and are considered a cost-effective alternative, whereas magnetic attachments demonstrate the lowest retention, limiting their clinical applicability. Evidence suggests that locator attachments are often preferred due to their versatility, low profile, and ability to accommodate implant angulation discrepancies^{3,9}.

Peri-implant tissue response appears to be largely independent of attachment type, provided adequate oral hygiene is maintained. Studies indicate no significant differences in marginal bone loss among various attachment systems, emphasizing the role of patient-related factors such as plaque control and maintenance protocols in determining peri-implant health^{10,11}.

Patient satisfaction is strongly influenced by retention, stability, comfort, and ease of use. Attachment systems providing higher retention, such as bar and locator attachments, are associated with greater patient satisfaction. Locator attachments, in particular, are favored due to their ease of insertion, reduced maintenance, and adaptability, especially in elderly patients. Magnetic attachments, due to their lower retention, are associated with comparatively lower satisfaction levels^{3,12}.

4. Factors Influencing Selection of Attachment System

The selection of an appropriate attachment system is multifactorial and should be individualized based on clinical and patient-related parameters. Inter-arch space plays a critical role, with limited space favoring the use of locator attachments due to their low profile. Implant parallelism is another important consideration, as non-parallel implants can be better managed with locator systems that accommodate angulation discrepancies. Bone quality and quantity influence load distribution, with resilient attachments being preferred in compromised bone conditions. Oral hygiene capability is particularly important when considering bar attachments, as they require meticulous cleaning to prevent peri-implant disease. Cost considerations and patient dexterity also play significant roles, with simpler systems being more suitable for elderly or physically compromised

patients^{11,13}.

Factors Influencing Selection of Attachment System

Table 2: Clinical Decision-Making Factors

Factor	Clinical Implication
Inter-arch space	Limited space favors locator
Implant parallelism	Non-parallel implants favor locator
Bone quality	Poor bone → resilient attachments
Oral hygiene	Bar systems require better hygiene
Cost considerations	Ball > Locator > Bar
Patient dexterity	Magnetic easiest for elderly

5. Emerging Trends and Evidence

Recent systematic reviews highlight an increasing preference for locator attachments due to their favorable clinical performance and reduced maintenance requirements. Additionally, single-implant overdentures have been explored as a cost-effective alternative, although they may be associated with higher prosthetic complications. Advances in attachment design continue to focus on improving retention, durability, and ease of maintenance. However, current evidence suggests that no single attachment system is universally superior, reinforcing the importance of individualized treatment planning^{14,15}.

Clinical Recommendations

Based on cumulative evidence:

Two-implant overdenture remains gold standard

Locator attachment = best overall choice (balance of retention, maintenance, cost)

Bar attachment = indicated for high retention demand

Ball attachment = cost-effective alternative

Magnetic attachment = limited use (low retention cases)

6. Conclusion

Mandibular implant-supported overdentures represent a predictable and effective treatment modality for edentulous patients, with consistently high implant survival rates across various attachment systems. While biological outcomes such as implant survival and peri-implant tissue health are comparable, significant differences exist in prosthodontic maintenance, retention, and patient satisfaction. Locator attachments offer an optimal balance between retention, resilience, and maintenance, making them a preferred option in many clinical scenarios. Nevertheless, the selection of attachment systems should be based on a comprehensive evaluation of anatomical, functional, and patient-related factors to ensure optimal long-term outcomes..

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